2010 Addendum to

2007 Angora Wildfire Hydrophobicity Field Monitoring Report
Lake Tahoe Basin Management Unit

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Introduction

This addendum presents the fourth year of data collection for hydrophobicity in the Angora Burn area. In the first year (USFS, 2007), six sites were selected for hydrophobicity measurements in the Angora Burn, to characterize impacts throughout various slopes within the burn area. Each of these six sites contained six or eight transects. Of these six monitoring sites, three were characterized as hydrophobic and three were not hydrophobic, as described below.

<u>Hydrophobic</u>

- Angora Ridge Upper: high intensity burn – SE aspect – upper slope
- Angora Ridge Lower: high intensity burn – SE aspect – lower slope
- Boulder Mtn. Lower: moderate intensity burn – SE aspect – lower slope

<u>Not hydrophobic</u>

- Tahoe Mtn. Upper: moderate intensity burn – NE aspect – upper slope
- Tahoe Mtn. Lower: high intensity burn – NE aspect – lower slope
- High School Site: high intensity burn - NE aspect- lower slope

As was noted in the original report, the variable that seemed to affect level of hydrophobicity the most was aspect, with the hydrophobic slopes all characterized by a southeast facing aspect. The 2007 data report can be obtained from the Lake Tahoe Basin Management Unit's public website (http://www.fs.fed.ujs/r5/ltbmu/). Navigate to "Maps and Publications", then to "Publications". Scroll down to 2007 and the report is called "Angora Fire Hydrophobicity Monitoring – 2007 Field Report".

The three sites that have remained hydrophobic the past three years were measured again in August 2010. These sites were 1) Angora Ridge – Upper, 2) Angora Ridge – Lower, and 3) Boulder Mountain. This year a fourth site outside of the burn area was also measured as a reference or control. The control variables used to select the reference site were soil series and aspect.

A model was created in ArcMap with these criteria to find a location with the same soil series and aspect as the other three sites (Figure 1). The three existing burn area sites are all in the Tallac soils series and have an east or southeast aspect. The control site was selected from all qualified areas due to its proximity to the other burn area sites as well as its accessibility. Soil moisture conditions at the time of sampling have been similar in all four years so moisture should not have an affect on the hydrophobicity of the soils.

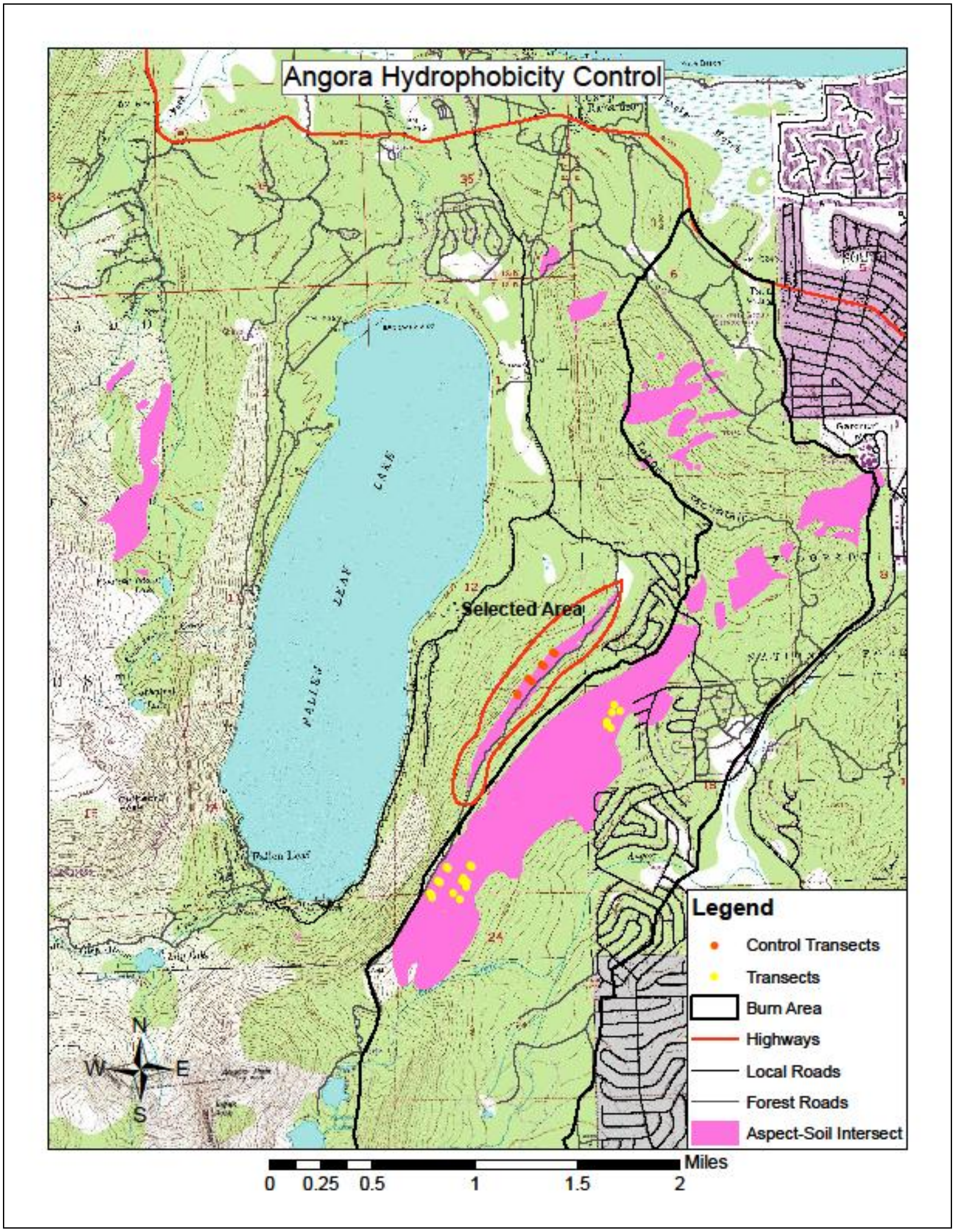

Figure 1. Map of selected control site. The highlighted areas all have the same soil series and aspect as the survey sites in the burn area.

Results

The percentage of high water repellency samples decreased only slightly at 2 sites compared with last year's results (1% at the Angora Ride upper site and 5% at the Boulder Mountain site). The percent of high water repellency samples increased slightly at the Angora Ridge lower site, by 6% from last year (Table 1). These changes may simply reflect the inherent variability of the sampling procedure rather than actual changes in soil conditions.

The control site has significantly lower high water repellency samples (41%) than burn area sites (85-89%). This confirms that the hydrophobicity in the soils is a product of the fire and not just a reflection of natural soil conditions.

Table 1: Angora Fire Hydrophobicity Results Summary

Percentage of samples with:						
Site Name	Year	High Water Repellency (%)	Low Water Repellency (%)	No Water Repellency (%)	Class Mean (ml/min)[1]	Hydro-phobicity Rating
Angora Ridge - upper	2007	80	9	11	3.3	Low
	2008	95	2.5	2.5	1.1	High
	2009	90	6	4	1.3	High
	2010	89	10	1	1	High
Angora Ridge - lower	2007	85	9	6	2	High
	2008	85	6	9	2.3	High
	2009	82	9	9	3	Low
	2010	88	10	3	1.2	High
Boulder Mountain	2007	80	12	8	2.2	High
	2008	96.7	1.7	1.7	0.8	High
	2009	90	8	2	1.2	High
	2010	85	13	2	1.2	High
Control	2010	41	33	26	5.5	Low

[1] Class Mean Rating: No hydrophobicity (≥ 8 ml/min)
Low hydrophobicity (3 to < 8 ml/min)
High hydrophobicity (< 3 ml/min)

Visual observation surveys were also conducted in 2010, once in early July and again in late October after a very large rain event. Visual survey traverses began at the end of Forest Mountain Road (the Boulder Mountain Hydrophobicity monitoring site), and extended parallel to Angora Ridge to approximately ¼ to ½ mile beyond the fire lookout. The return route was roughly parallel to this transect, but lower on the slope (Figure 4). The purpose of the visual surveys is to note changes in vegetation cover, and identify and monitor the development of any erosion features.

July 2010 Visual Survey Traverse: Vegetation cover and height has increased once again this year (Photo 1). In the high severity burn area, vegetation covers approximately 60-70% of the soil compared to 50% cover last year. There are more shrubs and brush than forbs, and shrubs are 1-2 feet tall. Trees have been planted, and the area around the trees has been scraped to bare soil in a 2-3 foot diameter circle. The trees are 6-15 inches tall. There are some patches where vegetative cover increases to about 80-90%. In the area above Lookout Point Circle, the trees show signs of high severity burn (no needles left), but vegetative cover increases to almost 100%. In this area, there are rushes, big lupine, columbine, snowberry, white thorn and other species. Some hydromulch is still intact and covers about 50% of the soil in some areas, but most areas have less than 50% hydromulch cover.

Photo 1: Vegetation in Angora burn area. Cover is approximately 80% in this area.

In moderate severity burn areas, soil is almost 100% covered with needle castings. Vegetative cover is noticeably greater than last year (approximately 65%). Vegetation includes snowberry, willows, gayophytum, ribes, manzanita, white thorn, prickly lettuce, mugwort, phacelia, and grasses and forbs. There are many forbs this year, especially prickly lettuce. There were also a few scattered bull thistles.

Some erosion features from overland flow were found again this year, but in a different location then previous years.. Multiple rills (about 10) were found during the July walking survey and are displayed on Figure 4. The aspect is north east facing in this area because it is on the side of a draw. The rills were approximately 6-10 inches wide and 6-12 inches deep, but almost all appear to be stabilizing (Photo 2). They have rounded banks and vegetation is filling them in. Pine needles and small branches have also deposited and accumulated in these features which have helped with stabilization. Most rills do not appear to have recently transported soil/sediment. The longest rill is approximately 100 feet long. This is the only area where we found erosion features during this walkthrough. The gully that was identified last year could not be relocated this year, probably due to the increase in vegetative cover.

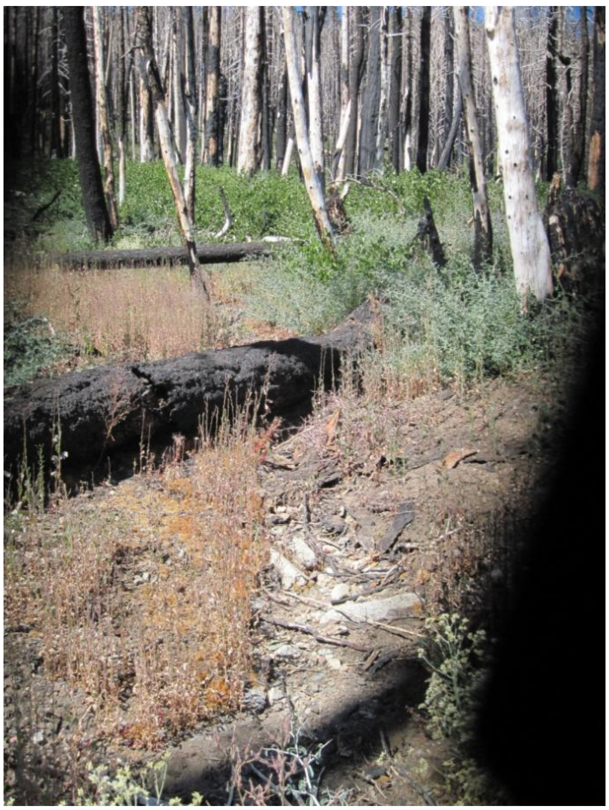

Photo 2:. Large rill in Angora burn area observed during July visual survey. Forest litter and vegetation appears to be stabilizing the rill.

October 2010 Visual Survey Traverse: On October 23-24, 2010 a significant storm event produced rainfall amounts of up to 8 inches in the Angora Burn area. A repeat of the visual survey traverse was subsequently conducted on October 26.

Along the upper portion of Angora ridge evidence of sheet erosion was essentially universal (Photo 3). Sheet erosion of sediment has been transported by the storm flow; however, evidence of significant concentrated flow in the form of large rills or gullies was mostly absent along the higher portion of the ridge. A few small and mostly discontinuous rills were observed along the upper half of the ridge (above approximately

7,000 feet). The largest rills observed were approximately 1-2” deep, 6-8” wide, 50’+ long (Photo 4). Vegetation (mostly white thorn, manzanita, and huckleberry oak) in this area is quite thick, in the range of 30-70% coverage, with an overall average brush coverage estimated at approximately 50%. Much of the eroded sediment was caught by this brush.

An area of more concentrated rilling was encountered at approximately 6,800 feet elevation the ridge at the location illustrated on Figure 2. The rilling here, although widespread, was fairly discontinuous. Average rill dimensions is estimated at 2-4” deep by 4-8 inches wide, and 10-20 feet in long. Spacing of rills in this area is estimated at 10-20 feet on average. Again, shrubs often interrupted the flow of sediment.

Between this area of concentrated rilling and the beginning of the traverse on Forest Mountain Road, the vegetation was even thicker than elsewhere, with the average coverage (from mostly manzanita) estimated at approximately 70%. Very little rilling was observed in this heavily vegetated area, and evidence of sheet flow was limited to larger openings.

Photo 3. Sheet erosion on upper slope of Angora Ridge observed during October visual survey (approximately 7,000 feet elevation).

Photo 4: Largest rill found during the October visual survey. Dimensions are 1-2” deep, 6-8” wide, 50’+ long.

<u>Conclusions</u>

Most soils in the Angora burn area still exhibit a high degree of hydrophobicity. Hydrophobicity results from the control site indicate that the high soil hydrophobicity in the burn area is due to fire, and not a reflection of natural soil hydrophocity . Some minor erosion is still occurring in some areas of the burn, yet vegetative cover and forest litter continues to increase and stabilize the slopes, and areas of observed erosion occurred in different places than observed in previous years.

The intense storm of Oct. 23-24, 2010 produced approximately 8” of rain in 24 hours. This caused sediment to be moved throughout the burn area; however, evidence of long, continuous erosion in the form of rills and gullies was absent. The high degree of vegetative ground cover (average >50%) appears to have prevented long continuous flow paths from forming. The roots from new vegetation can help break up hydrophobic layers and create pathways through which water can infiltrate. Rodents, worms and insects can also create holes through hydrophobic layers which water can pass through, reducing runoff. As the Angora burn area continues to be re-populated with vegetation and animals, the soils should continue to become more stable and less prone to erosion.

Because hydrophobicity monitoring over the past four years has shown no significant change, and significant sediment delivery to stream channels no longer appears be a major threat, we recommend that the frequency of monitoring (hydrophobicity and visual survey traverse) be reduced. Therefore hydrophobicity monitoring and visual surveys are scheduled to be repeated in the same year as the next planned aerial photography flight of the burn area, in 2013.

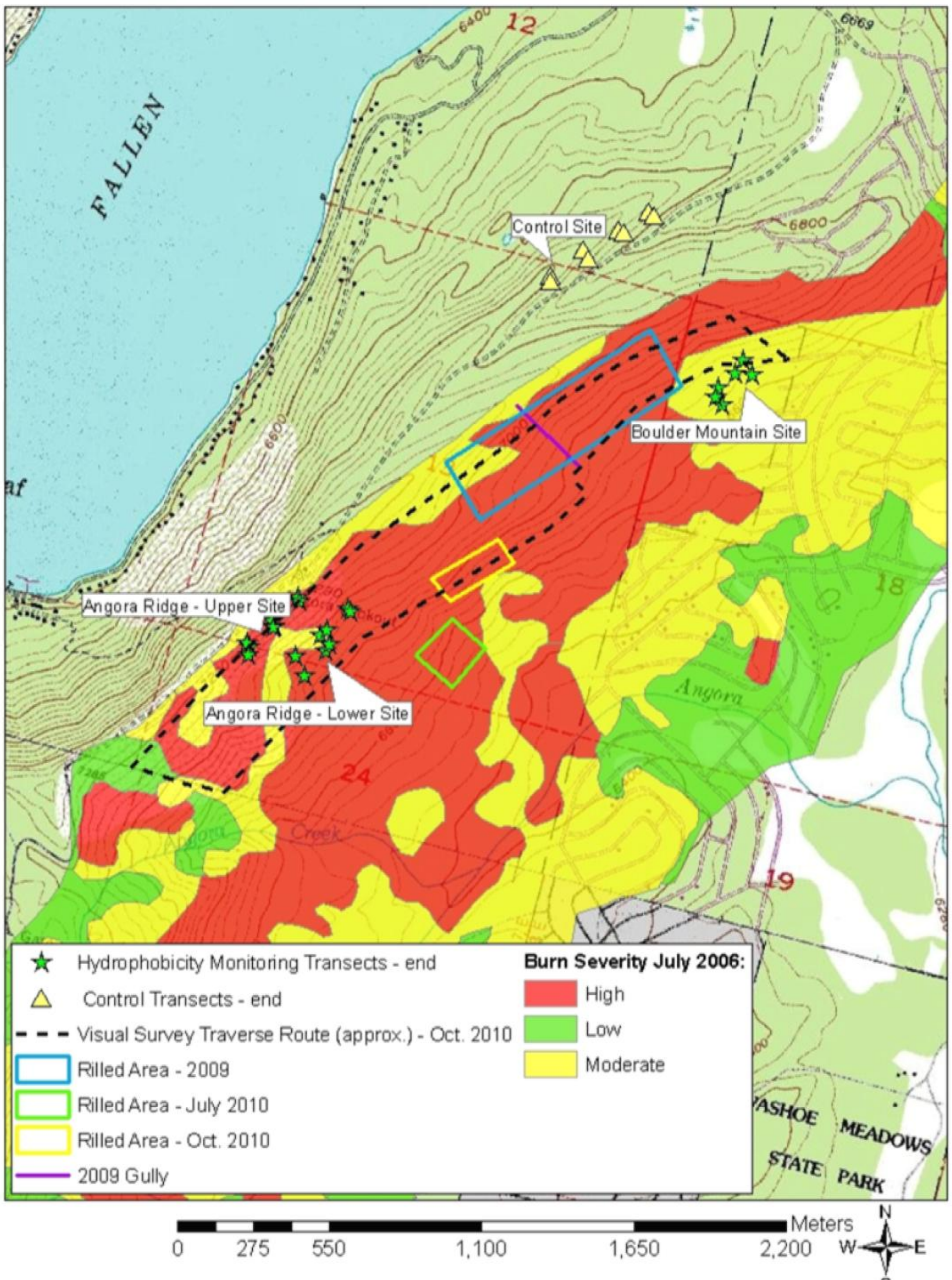
FALLEN
Control Site
Boulder Mountain Site
Angora Ridge - Upper Site
Angora Ridge - Lower Site
12
18
19
24
Angora
6800
Hydrophobicity Monitoring Transects - end
Control Transects - end
Visual Survey Traverse Route (approx.) - Oct. 2010
Rilled Area - 2009
Rilled Area - July 2010
Rilled Area - Oct. 2010
2009 Gully
Burn Severity July 2006:
High
Low
Moderate
WASHOE MEADOWS STATE PARK
Meters
0
275
550
1,100
1,650
2,200
N
W
E
S

Figure 2. Map of the locations of erosion in the Angora burn area identified during 2009, July 2010, and October 2010 visual observation surveys. Hydrophobicity monitoring transects are also displayed.